Space Weather Technical Forecast

Issued on Sunday 24 November 2024 at 00:47 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate Solar Activity likely with occasional R1 Radio Blackouts likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with two lower M-flares, peaking M1.1 at 23/1607 UTC. There are ten active regions on the visible disc, two of which is currently unnumbered. The most notable are the two regions in the southeast. In particular, AR3906 appears to have a notable trailer, set within plage and with further complexity likely to become apparent as it rotates further into view. The magnetic complexity of these regions currently difficult to ascertain due to viewing angle, however AR3905 does look to contain a tenuous delta spot within the penumbra of its leader spot. This should become more apparent as it continues to rotate further onto the disc. The remaining spots on the disc are generally relatively small and simpler in complexity, with limited notable growth.

No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds speeds measured by ACE at L1 were background to slightly elevated at 360-430km/s, with density near average or just below. The Interplanetary Magnetic Field (IMF), Bt, was Weak to Moderate, between 5-8nT. The north-south component was also Weak and variable in direction, ranging between +7nT and -6nT. Phi angle was mainly negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background. The associated 24-hour fluence remained below Active, with 1.59e6 total pfu observed at 24/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Generally Moderate activity is expected, with occasional M-flares expected, and a slight chance of an isolated X-class flare.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs forecast. Current background to slightly-elevated winds may become enhanced at times early in the period due to negative coronal hole enhancement. No other recurrent or forecast enhancement is then expected with winds expected to remain at generally background levels.

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Geomagnetic activity is expected to remain at Quiet to Unsettled (kp1-3) levels through the period, with a chance of Active (kp4) intervals through Days 1 and 2 (24-25 Nov).

Energetic Particles / Solar Radiation: High energy protons are expected to persist at background, with a very slight chance of enhancement from any of the regions currently on the disc. High energy electron flux is expected to be mainly background with the associated Active fluence remaining well below the Active threshold.

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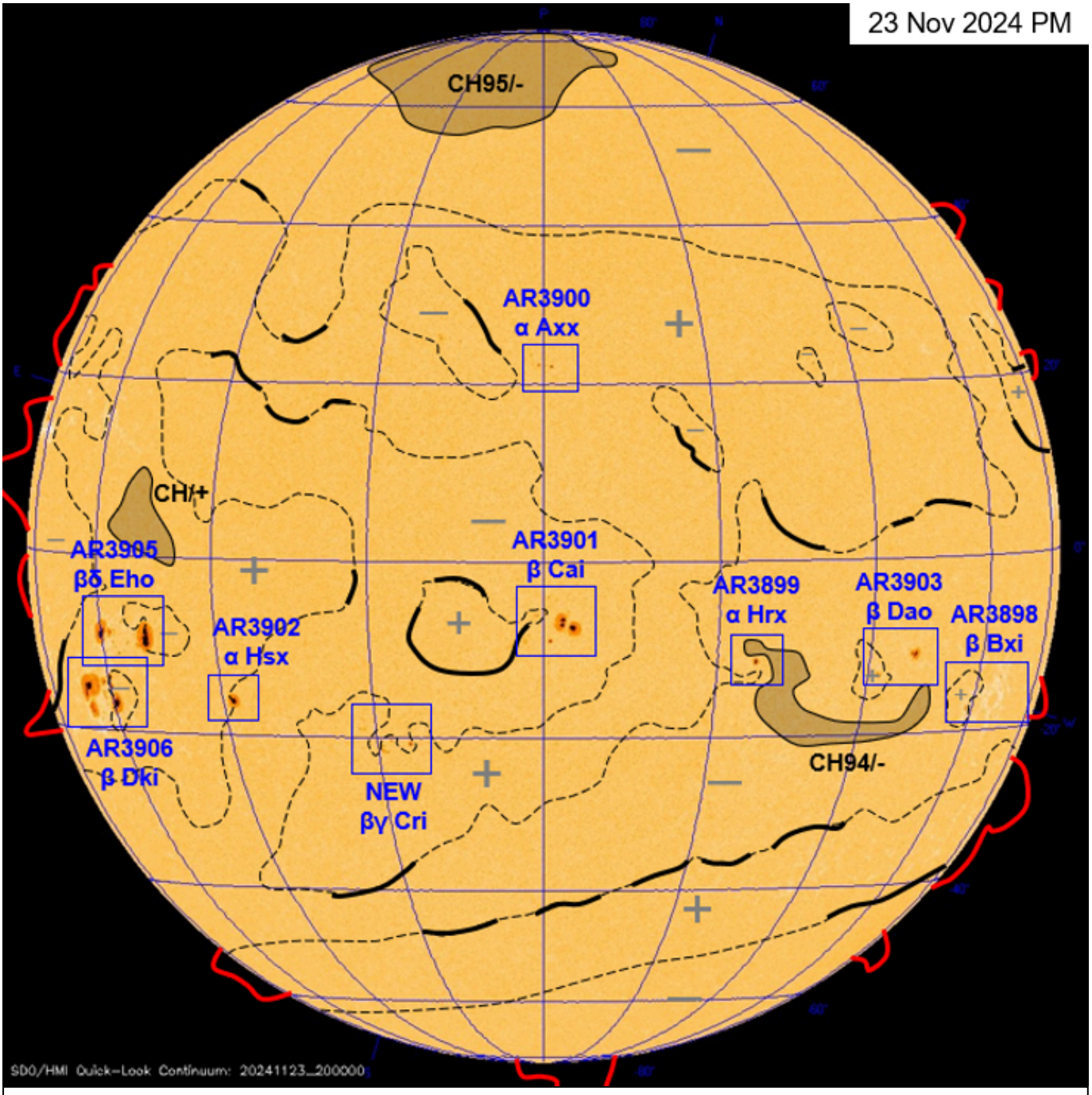
Figure 1: Solar Synoptic Map Valid 23/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are currently no Earth-directed CMEs forecast.

Current background to slightly-elevated winds may become enhanced at times early in the period due to negative coronal hole enhancement from CH94/-, or perhaps the no longer discernible CH93/-, both regions have become increasing faint and small over the past few days and any significant connection appears increasingly unlikely. No other recurrent or forecast enhancement is then expected with winds expected to remain at generally background levels. MOSWOC ENLIL model output continues to severely over-estimate solar winds, verifying poorly and current output not preferred.

Geomagnetic activity is expected to remain at Quiet to Unsettled (kp1-3) levels through the period, with a chance of Active (kp4) intervals through Days 1 and 2 (24-25 Nov).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Radio Blackouts - X-Ray Flares

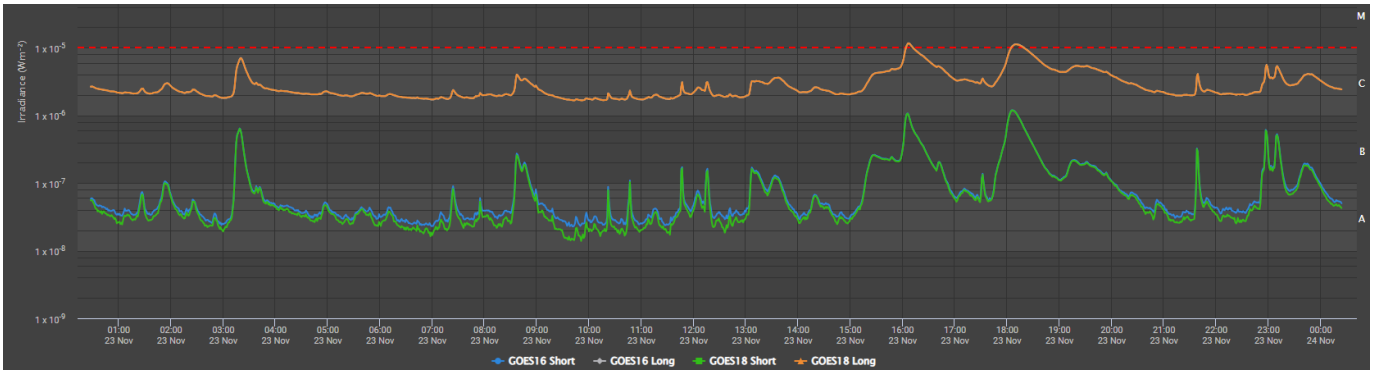
The visible disc continues to grow in activity with ten sunspot regions now present and solar radio flux continuing a steady rise. The most notable regions rotating onto the southeast limb and likely carry the bulk of current significant flare risk. AR3906 appears to have a notable trailer, set within plage and with further areal growth and complexity likely to become apparent as it rotates into view. The magnetic structure of this spot is currently difficult to accurately ascertain due to the viewing angle. AR3905, to its north, appears to be magnetically simpler, as an E-W aligned bipolar spot, however signs of a small delta region are viable within the leading portion, this should become clearer as it rotates into view. The spots across the rest of the disc are generally relatively small and simple, with limited growth. AR3901 has seen the most activity in recent days and continues to present the risk of further flares.

All major flare risk regions remain on the disk through the forecast period, with far-side sounding data and recurrence suggesting the likelihood of further regions rotating on. A bright area on the northeast limb in SDO AIA imagery suggesting at least one regions is imminent.

Overall solar activity is expected to be generally Moderate, with occasional M-flares likely and a slight chance of isolated X-class flares, primarily from from the regions in the southeast. Risk is maintained steady through the period pending further developments and assessment of oncoming regions.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	60	60	60	60
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 2: Latest 24hr GOES16/18 X-Ray Flux trace.



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Solar Radiation Storms (High Energy Protons)

The recent enhancement to the GOES-18 Proton flux has now declined to background. This enhancement occurred due to a large eruption from over the west limb on 21 Nov, and was a relatively hard event with responses also observed in higher energy channels, including >100 MeV and >500 MeV. The likely source region, while impossible to observe and assess if it survived this event, could potentially produce further notable eruptions. However these are increasingly unlikely to influence Earth if they occur.

The regions currently on the visible disc are currently unlikely to produce observable proton events, with the most likely flare sources currently near the southeast limb. The observed proton Flux is subsequently expected to persist at background levels with a slight but rising chance of further enhancement into the period as larger sunspot regions continue to transfer towards the western hemisphere of the disk.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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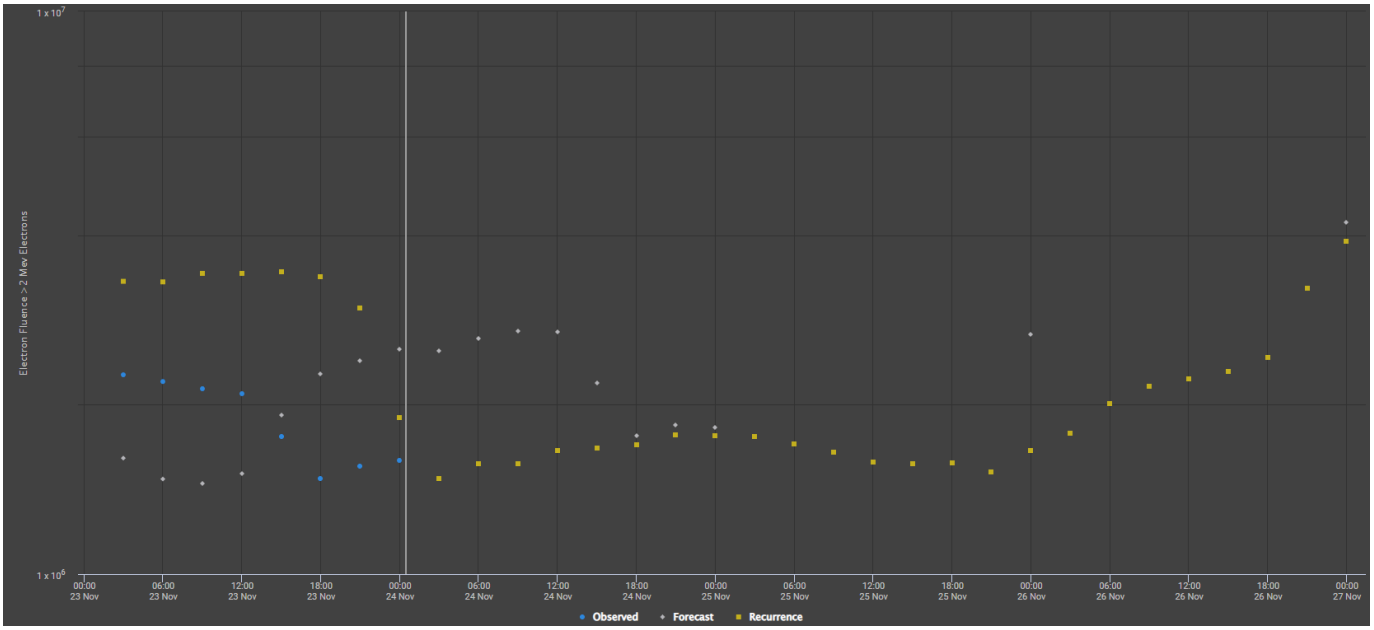
High Energy Electrons (≥ 2MeV)

Electron flux observed by GOES-16 at GEO has been at background, and is expected to persist at this level, with a chance of diurnal increases to Moderate levels.

The associated 24 fluence is expected to persist well below the Active level, with MOSWCO REFM output thought to be providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM output.



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